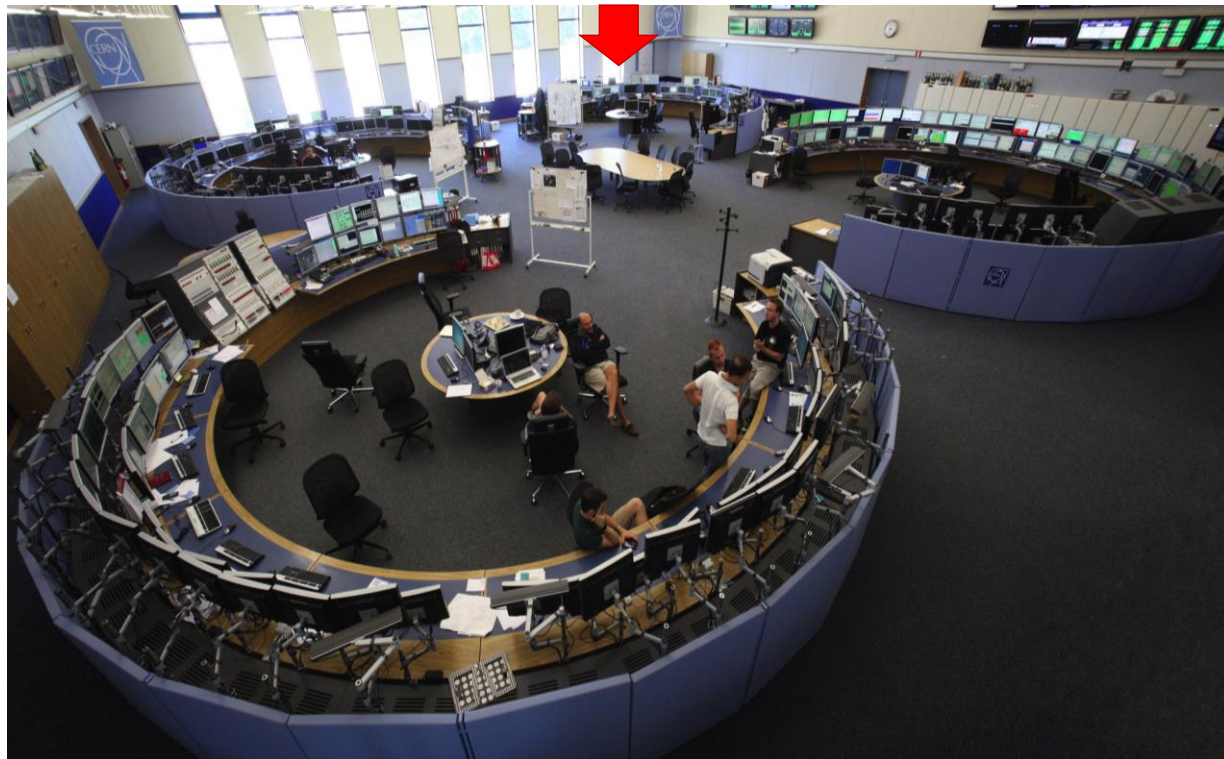
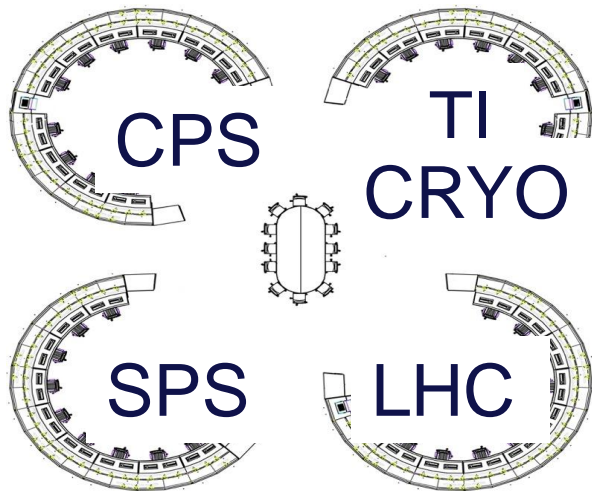


# CERN TECHNICAL INFRASTRUCTURE OPERATIONS

How we do business today and vision of the future !

# Technical Infrastructure operations at CERN today, how is it done?



# Role of the TI operations

- Monitor alarms for all technical infrastructure at CERN
- Electricity, cooling, ventilation, safety, access, IT, etc.
- Coordinate major events between teams on the field and crisis teams
- Handle repair requests and maintenance
- On-site first-on-scene interventions when possible

# Alarm screen: *Unique alarm screen for **almost** all alarms*

- Only “grouped” alarms
- Specialist views for detailed alarms only

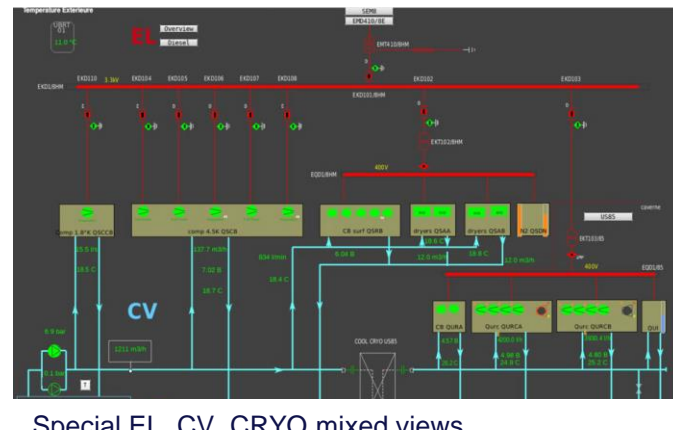
The screenshot displays the CERN ELPALARM interface. The top navigation bar includes 'CERN ELPALARM', 'Console LHC', 'MASKED (88)', 'ALARM', and 'MAP'. A search bar and user profile 'JESPERN' are also visible. The main content area is divided into three columns:

- Process Alarms:** A list of 12 alarms, each with a green status indicator. The alarms include: 'Defaut presence 400VAC', 'Coupure electrique confirmee', 'Defaut poire LSL1001 niveau tres bas bassin reservoir', 'Defaut poire LSL1003 niveau tres bas bassin reservoir', 'Defaut 2 poires LSL2001 + LSL2002 niveau tres bas bassin reservoir', 'Defaut presence 230VAC', 'Defaut presence 24VDC', 'Arret d'urgence installation', 'Defaut niveau bas bassin reservoir', 'Defaut sonde de niveau de bassin reservoir LT1002', 'Defaut general IO ? rack error', and 'Defaut general sonde de mesure'.
- Copies:** A column containing 12 green status indicators, corresponding to the 12 alarms in the Process Alarms column.
- CCC Alarm:** A single alarm with a green status indicator: 'DEFAULT MAJEUR INSTALLATION SF1'.

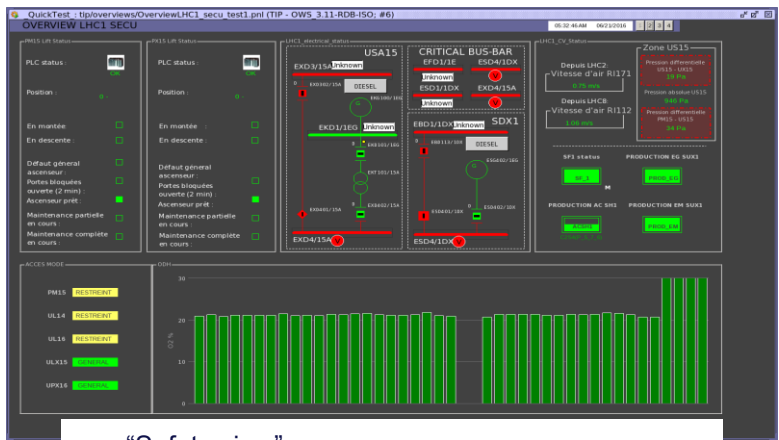
A left sidebar shows a time-based navigation menu with dates from 02-Mar-2021 to 17-Jun-2021, and 'Today' entries.

# Synoptics used today

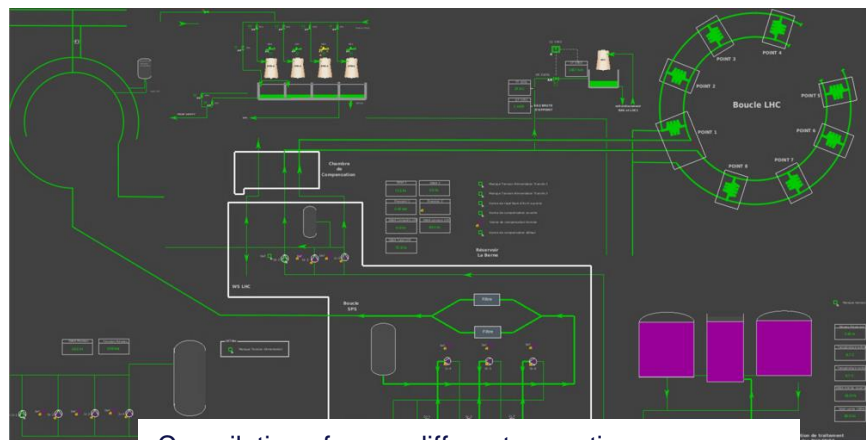
- Moving towards same system for synoptics for everything
- Started mixing data from different groups: **Very efficient approach!**
- **Collaboration** with EL, CV, EPC, ICS, CRYO, IT and others.



Special EL, CV, CRYO mixed views



- “Safety view”
- Mixed data for a LHC point
- (ODH, Safe Zone pressure, power, lifts, comms, etc.)



Compilation of many different synoptics  
In this case all CERN primary water

# Alarms and synoptics

- **Using grouped alarms to have less alarms in general, especially during breakdown**
- **Details available in specialist alarm screens**
- **Same tool for all alarms, less tools to know**
- **Same tool for synoptics across CERN: Huge gain in learning and adapting to a new system!**

# Points of action

## Eyes on the field

- *Drones, robots, infrared*
- *Augmented reality*

## Remote operations

- *Remote controls of installations*
- *Increased measurements*

## Documentation, naming conventions

- *Much more details about each equipment*

## Advanced tools

- *Dynamic fault detection*

# Eyes on

- Importance of s
- Daily or weekly  
calm times
- Adding infrared
- allow to detect
- Automatic round
- compare value



on locally

ould be done during

asurements would

blems in installations.

arning (it will easily

and warn operator)



# Drones

- Usage of drones remotely from the control room to have a live feed from the field.
- Would give very valuable information whenever we have suspicion about things like water leaks, smoke detection, etc. that usually require an access and human intervention.
- Requests for adding cameras in service caverns show a real demand for this:  
<https://edms.cern.ch/document/1808504/1>

# Robots

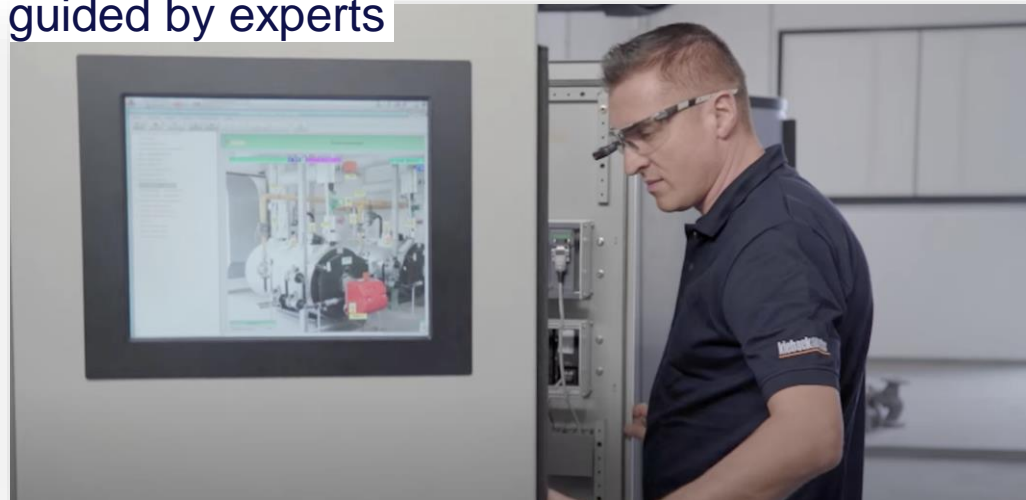
- Alternatively to the drones we could imagine also robots, they would be slower but have the advantage of being able to stand still much longer and serve a live video feed without running out of battery too quickly.
- Could imagine robots having tools, controlled remotely too.

# Augmented Reality



# Virtual glasses

- Sending live feed from what on-site technician sees to better guide him
- Specialist can guide first-on-scene interveners remotely
- Some companies use this already today
- Possible to work with local staff, guided by experts



# Remote operations

- Big value in operating remotely with a big machine.
- With good diagnostics and measurements it is inevitably easier to operate remotely too.

# More control remotely

*Controls of systems in the field are not always accessible for control room operators at CERN: Are some of the reasons historical or technical complexity?*

- Many different groups at CERN
- Hard to define responsibilities (who is allowed to do what?)
  - **Change of "how we do" at CERN?**
- Are operators well enough aware of the installations in question ?
- **Sharing of specifics about installations could be improved?**
- **Compare to other companies, lessons learned?**
- At CERN we prefer to switch on electrical installations locally, whilst it is actually possible to do it remotely
- Some things were true 50 years ago, not necessarily today

# Increased diagnostics

*Make it easier to intervene and diagnose remotely*

- Extensive usage of circuit breaker like the master pact series from Schneider that accept remote control and remote reset, also in low voltage?
- Increase measurements on electrical supplies.
- Dedicated electrical lines for groups of equipment, when you install new equipment group you install device to measure too.
- Compare cost vs benefit of monitoring more low voltage installations also?

# Documentation, naming conventions

- Should it be possible to install and power an equipment without properly documenting ?
- Would it be interesting to know from where an equipment is powered, how is it connected to IT, what it is powering, etc. ?
- Good value in easily having a map of information related to an equipment ?



# Powering equipment

- Powerful tools like INFOR EAM already exist at CERN
- Interesting to work towards more uniform way of exploiting and inserting this data ?
- **Often the limit is today not the tool but the data structure.**

The screenshot displays the INFOR EAM software interface. On the left, an 'Equipment Tree' lists various equipment items under the position 'EBD11\*8C'. The main panel shows details for 'Position EBD11\*8C', including a 'GENERAL' section with description, service unit, and status, and a 'DETAILS' section with class, category, commission date, and assigned to. On the right, an 'EDMS DOCUMENTS' table lists documents with their IDs, titles, and statuses.

ID	Title	Status
MEYEBD_0002 v.0	BUILDING 352 - EBD11*8C	Released
MEYEBD_8001 y.AH	EAST AREA - HALL 157 - 400V ELECTRICAL DISTRIBUTION	Released
MEYEBD_0002 y.AA	BUILDING 352 - EBD11*8C	Engineering Check
MEYEBD_8001 y.AJ	EAST AREA - HALL 157 - 400V ELECTRICAL DISTRIBUTION	Engineering Check

# Examples of added value?

- Lots of information available in tools like GIS already
- Links between equipment ?
- Click an equipment and see relations?



*Pilot projects were done several times: Often problem with combabilities between databases, technologies were show stoppers*

# Advanced tools

- Grouping alarms together intelligently
- Hierarchy of alarms
- Logbooks entries based on fault detection
- Advanced tools can predict failures, using machine learning already today

# Common points

- It is not possible to predict the future
- Some of these techs are already there, others may appear!
- Really important thing is to plan for it at the design phase, **and be ready to adapt**

# Conclusion: Interesting times ahead!

**Eyes on the field:** *Confirm a fault remotely*

**Remote operations:** *Avoid travel time for simple operations*

**Documentation, naming conventions:** *Simplify collaborations, make tools work together easily*

**Advanced tools:** *Make intelligent use of all the data we have and will have available*